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**Mizuno et al.**

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(54) **SEWING MACHINE MODULE AND SEWING MACHINE**

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***D05B 27/02*** (2006.01)
***D05B 57/00*** (2006.01)

(52) **U.S. Cl.**
CPC ..... ***D05B 73/00*** (2013.01); ***D05B 27/02*** (2013.01); ***D05B 57/00*** (2013.01)

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USPC ..... 112/258, 14, 38, 90, 95, 106, 470.03, 112/470.14, 470.18, 318, 323, 220, 463, 112/232
See application file for complete search history.

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(57) **ABSTRACT**

A sewing machine module mounted in a sewing machine that includes a feed mechanism, a shuttle mechanism, a frame that covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism and that supports the feed mechanism and the shuttle mechanism in a state in which a top side of the feed mechanism and a top side of the shuttle mechanism are open, a cover member that is formed into a flat plate shape and that covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame, and a joining mechanism that joins the frame and the cover member.

**7 Claims, 7 Drawing Sheets**

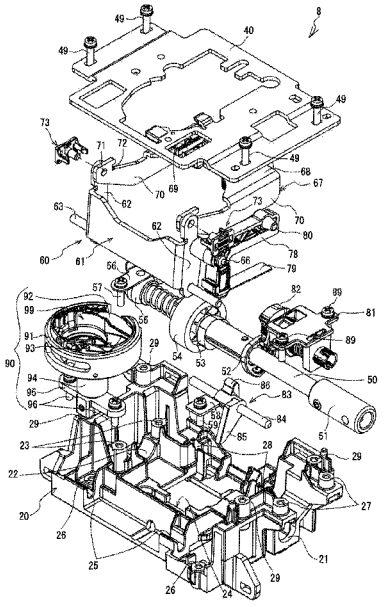

FIG. 1

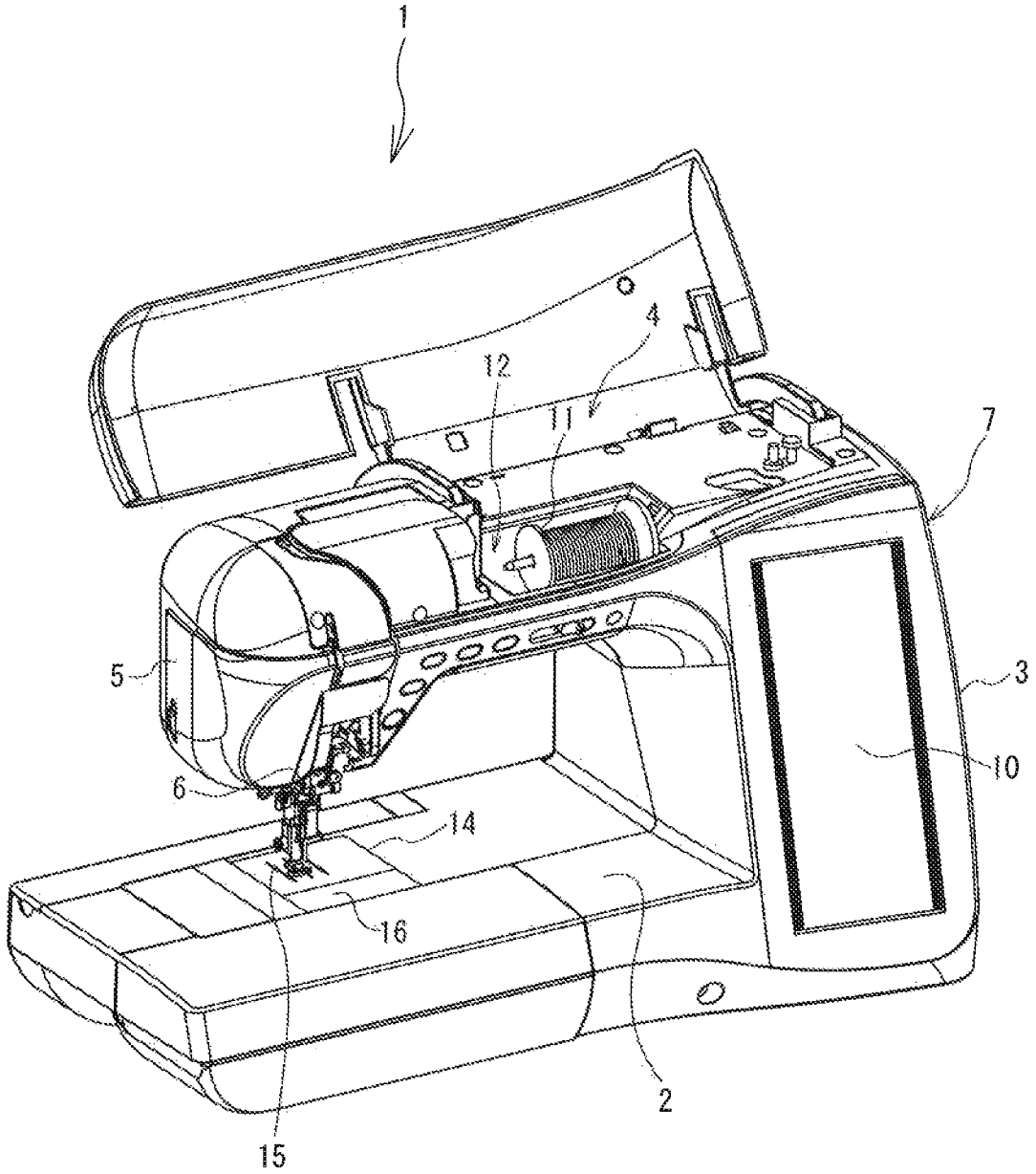

FIG. 2

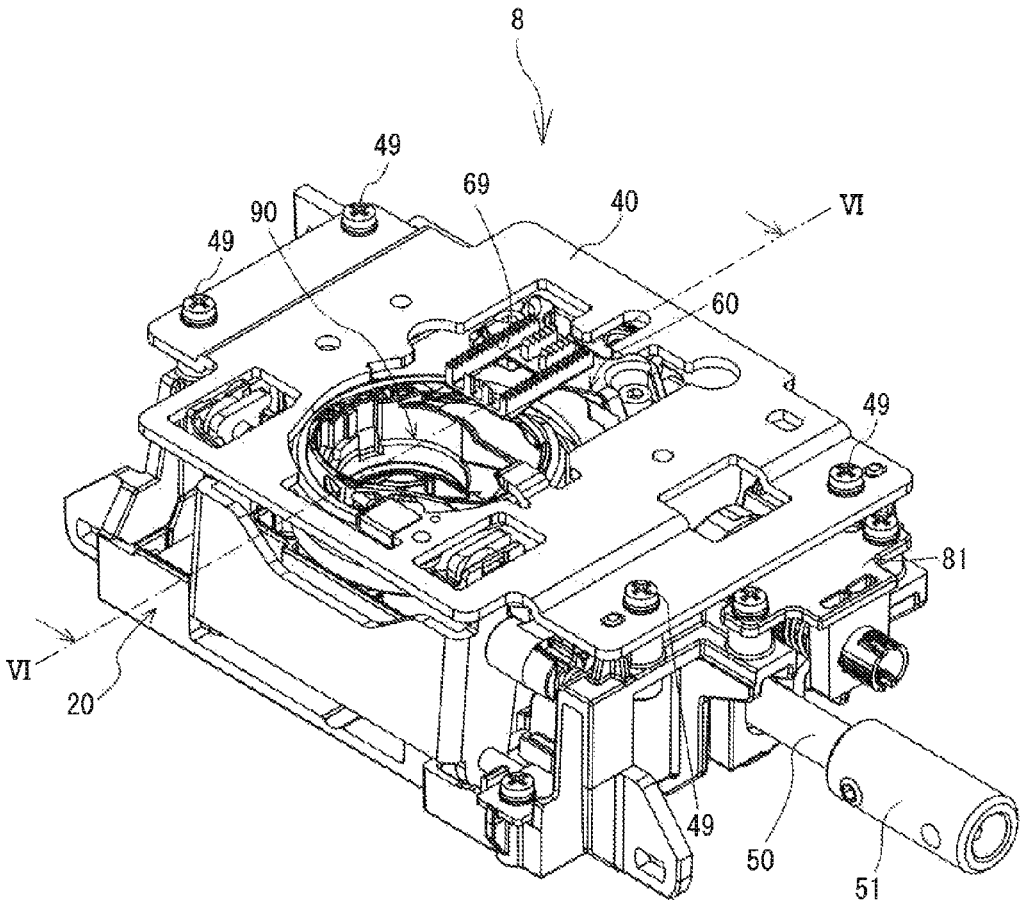

FIG. 3

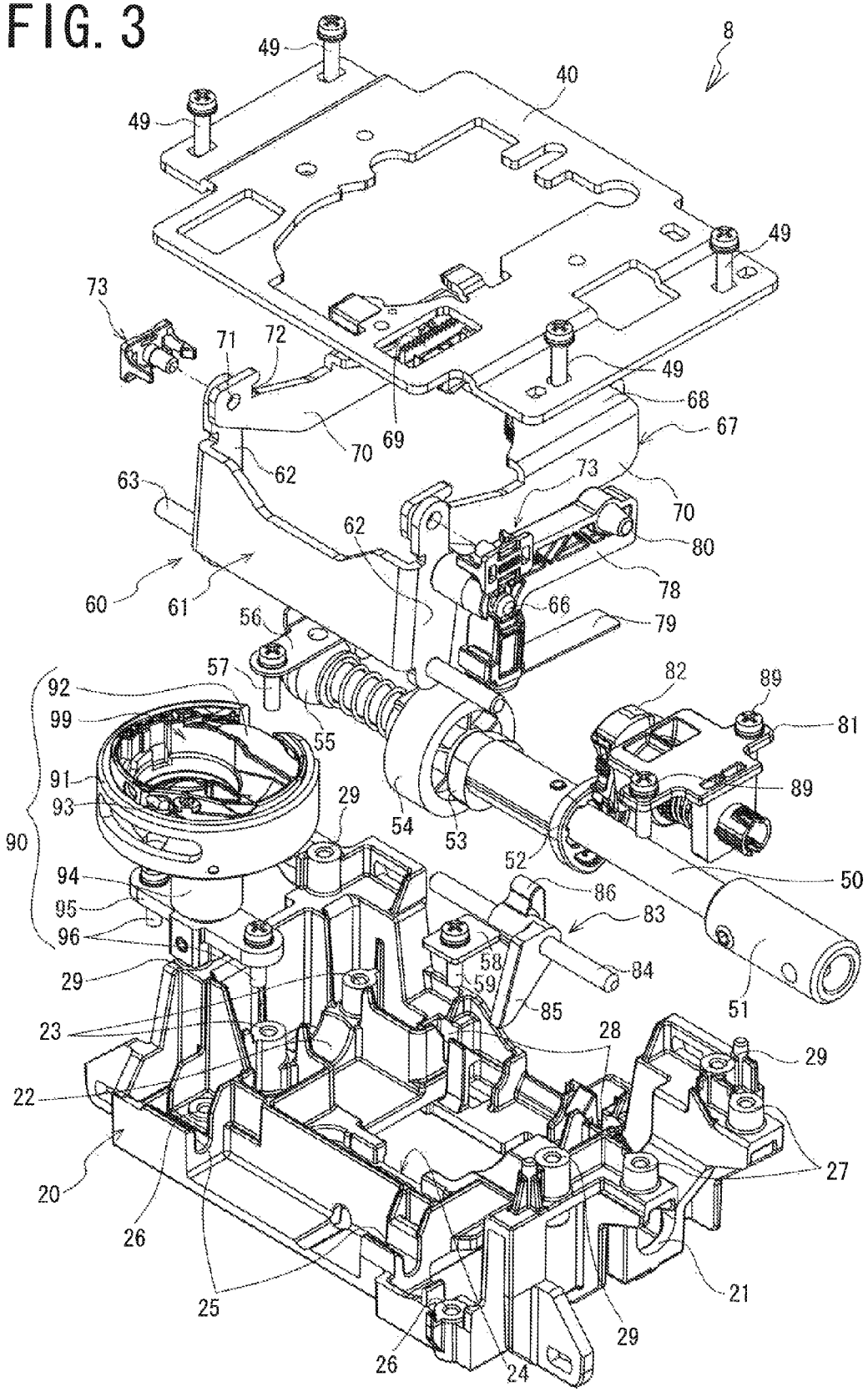
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FIG. 4

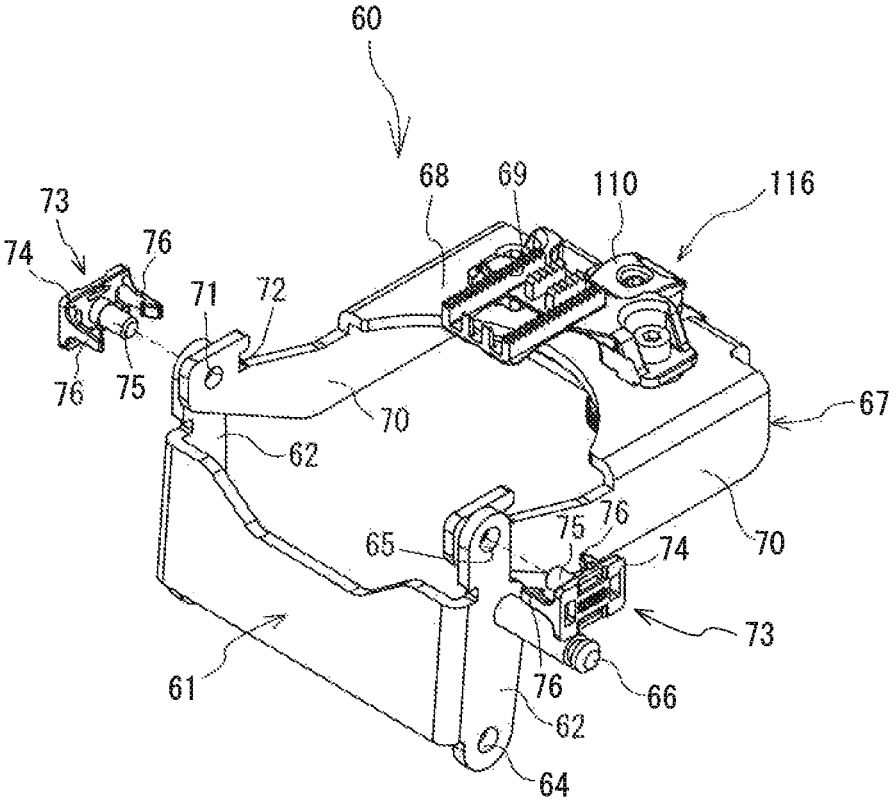
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FIG. 5

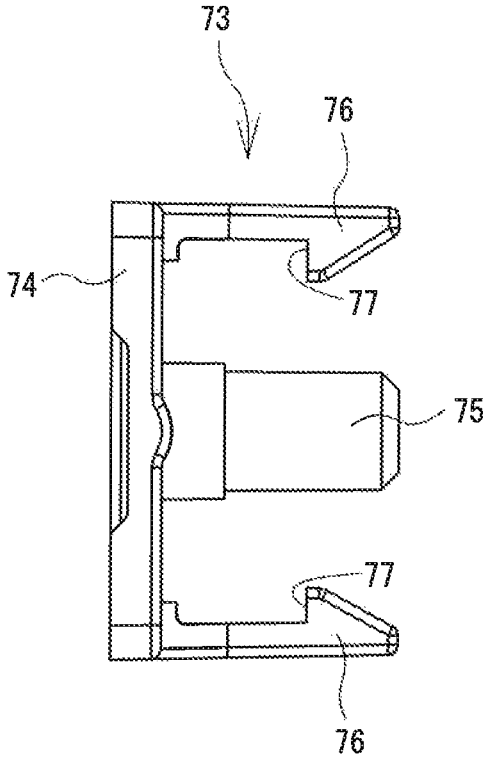

FIG. 6

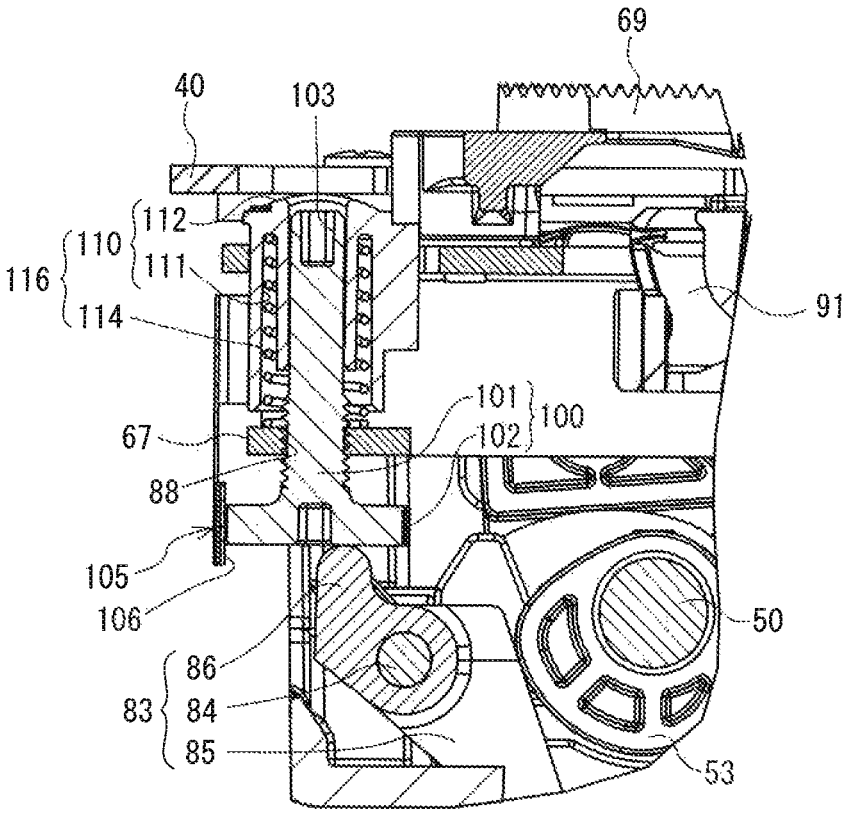
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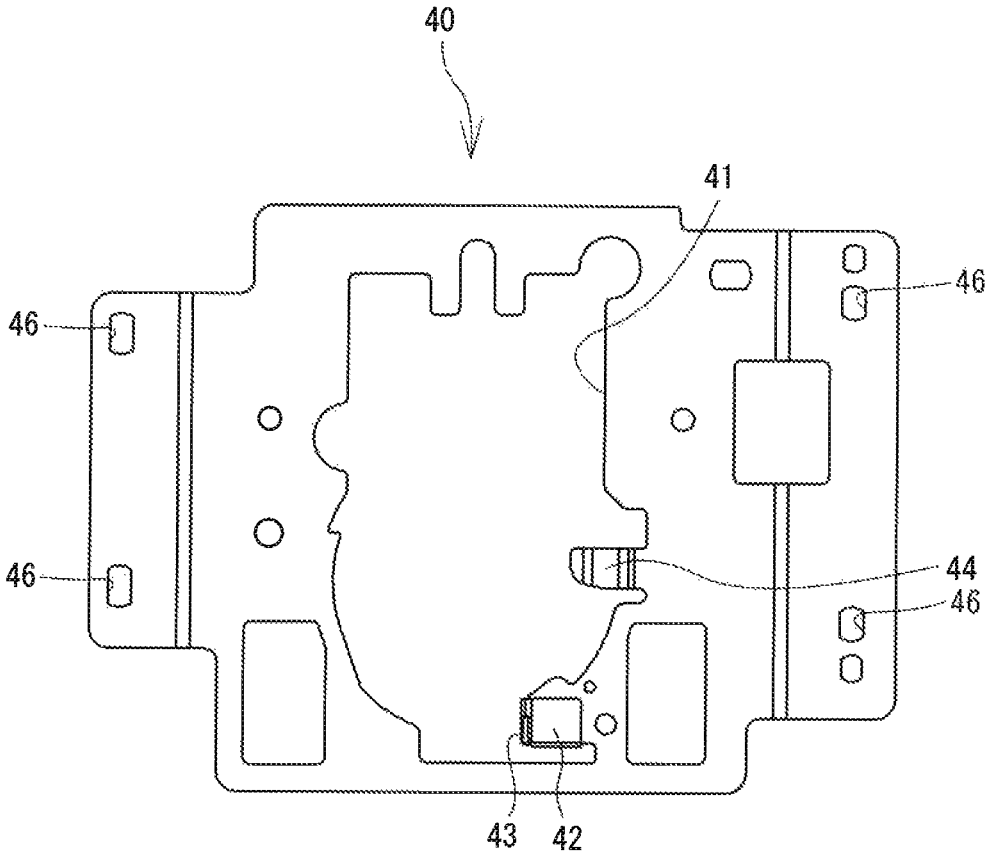
FIG. 7



# SEWING MACHINE MODULE AND SEWING MACHINE

## CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2012-072930, filed on Mar. 28, 2012, the content of which is hereby incorporated by reference.

## BACKGROUND

The present disclosure relates to a sewing machine module that is provided with a feed mechanism and a shuttle mechanism, and to a sewing machine that is provided with the sewing machine module.

Cases are known in which a sewing machine module that has been manufactured such that the sewing machine module combines a plurality of mechanisms is mounted on a sewing machine in order to improve the production efficiency of the sewing machine. For example, the sewing machine module is manufactured by attaching a feed mechanism and a shuttle mechanism to a base plate.

The sewing machine module must be provided with high rigidity. In a known sewing machine module, the rigidity of the sewing machine module is ensured by bending a metal plate with high rigidity into a complex shape to form the base plate. Members that configure the feed mechanism and the shuttle mechanism are attached to the formed base plate from various directions.

## SUMMARY

However, the process by which the base plate is formed by bending and the process by which the members are attached to the base plate from various directions are both complicated processes. Therefore, with the known technology, it is difficult to manufacture a sewing machine module that is provided with high rigidity.

The present disclosure provides a sewing machine module that is provided with high rigidity and can be manufactured easily, and also provides a sewing machine that is provided with the sewing machine module.

A sewing machine module mounted in a sewing machine according to a first aspect of the present disclosure includes a feed mechanism, a shuttle mechanism, a frame, a cover member, and a joining mechanism. The frame covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism. The frame supports the feed mechanism and the shuttle mechanism in a state in which a top side of the feed mechanism and a top side of the shuttle mechanism are open. The cover member is formed into a flat plate shape and covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame. The joining mechanism joins the frame and the cover member.

A sewing machine according to a second aspect of the present disclosure includes a sewing machine module. The sewing machine module includes a feed mechanism, a shuttle mechanism, a frame a cover member, and a joining mechanism. The frame covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism. The frame supports the feed mechanism and the shuttle mechanism in a state in which a top side of the feed mechanism and a top side of the shuttle mechanism are open. The cover member is formed into a flat plate shape and covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame. The joining mechanism joins the frame and the cover member. The sewing machine module is mounted in a sewing machine casing of the sewing machine in a state in which the frame and the cover member are joined by the joining mechanism.



## BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be described below in detail with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of a sewing machine **1**;

FIG. **2** is a perspective view of a sewing machine module **8**;

FIG. **3** is a perspective exploded view of the sewing machine module **8**;

FIG. **4** is a perspective exploded view of a portion of a feed mechanism **60**;

FIG. **5** is a plan view of a coupling member **73**;

FIG. **6** is a figure that shows a portion of a section view along a line VI-VI in FIG. **2**, as seen from the direction of the arrows in FIG. **2**; and

FIG. **7** is a plan view of a cover member **40**.

## DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Hereinafter, an embodiment of the present disclosure will be explained with reference to the drawings. Note that the drawings are used for explaining technological features that the present disclosure can utilize, and the drawings are not drawings whose purpose is to restrict the nature of the present disclosure. First, a physical configuration of a sewing machine **1** will be explained with reference to FIG. **1**. In the explanation that follows, the lower left side, the upper right side, the upper left side, and the lower right side in FIG. **1** respectively define the left side, the right side, the rear side, and the front side of the sewing machine **1**.

As shown in FIG. **1**, a sewing machine casing **7** of the sewing machine **1** includes a bed **2**, a pillar **3**, an arm **4**, and a head **5**. The bed **2** is a base portion of the sewing machine **1** and extends in the left-right direction. The pillar **3** extends upward from the right end of the bed **2**. A liquid crystal display (LCD) **10** is provided on the front face of the pillar **3**. A touch panel is provided on a surface of the LCD **10**. The arm **4** extends to the left from the upper end of the pillar **3**, such that the arm **4** is opposite the bed **2**. A drive shaft (not shown in the drawings) that extends in the left-right direction is contained in the interior of the arm **4**. A spool mounting portion **12**, on which a spool **11** that is used in sewing is mounted, is formed in the upper portion of the arm **4**. The head **5** is provided on the left end of the arm **4** and is provided with a needle bar **6** and the like.

A needle plate **14** and a needle plate cover **16** that can be opened and closed are provided on the top face of the bed **2**. A sewing machine module **8** (refer to FIG. **2** and the like) is mounted inside the bed **2** underneath the needle plate **14**. As will be explained in detail later, the sewing machine module **8** is provided with a feed mechanism **60**, a shuttle mechanism **90**, and a lower shaft **50**. The feed mechanism **60** moves a sewn object (for example, a cloth). The shuttle mechanism **90** grips an upper thread. The lower shaft **50** transmits a rotational force of a sewing machine motor (described later) to the feed mechanism **60** and the shuttle mechanism **90**. A rectangular hole **15** into which and from which a feed dog **69** (refer to FIGS. **2** to **4** and the like) rises and descends is formed in the

needle plate **14**. When the feed dog **69** is in a state in which it is protruding upward from the rectangular hole **15** and is engaged with the sewn object, the feed dog **69** moves the sewn object by moving horizontally.

The sewing machine motor (not shown in the drawings) is provided underneath the interior of the pillar **3**. The sewing machine motor rotates the drive shaft. When the drive shaft rotates, a needle bar up-and-down moving mechanism (not shown in the drawings) operates, the needle bar **6** moves up and down, and sewing is performed. The rotating of the drive shaft is transmitted to an intermediate shaft (not shown in the drawings) through a drive belt (not shown in the drawings). The intermediate shaft is supported in the interior of the bed **2** such that the intermediate shaft can rotate. The intermediate shaft is coupled to and rotates as a single unit with the lower shaft **50**.

Hereinafter, the sewing machine module **8** will be explained. The lower left side, the upper right side, the upper left side, and the lower right side in FIGS. **2** and **3** respectively define the front side, the rear side, the left side, and the right side of the sewing machine module **8**. As shown in FIGS. **2** and **3**, the sewing machine module **8** is structured such that the feed mechanism **60**, the shuttle mechanism **90**, the lower shaft **50**, and the like are integrated into a single unit by a frame **20** and a cover member **40**. The sewing machine module **8** can therefore be mounted in the sewing machine **1** more easily than in a case where the feed mechanism **60**, the shuttle mechanism **90**, and the like are mounted separately in the sewing machine **1**. Furthermore, the sewing machine module **8** is not limited to being mounted in the sewing machine **1** of the present disclosure, and the sewing machine module **8** can also be mounted in a plurality of types of sewing machines. Accordingly, production efficiency and maintenance efficiency are improved by the use of the sewing machine module **8**.

The overall structure of the sewing machine module **8** will be explained. As shown in FIGS. **2** and **3**, the frame **20** forms what is approximately a box shape and is open at a top side. The frame **20** covers the sides and the bottoms of the feed mechanism **60** and the shuttle mechanism **90**. The feed mechanism **60**, the shuttle mechanism **90**, and the lower shaft **50** are attached to the frame **20** from the upper side of the frame **20**. The cover member **40** is an approximately flat plate member and is joined to the frame **20** by four screws **49** on the open top side of the frame **20**. The frame **20** and the cover member **40** will be described in detail later.

The lower shaft **50** will be explained. As shown in FIG. **3**, the lower shaft **50** extends in the left-right direction. The lower shaft **50** is supported approximately in the center of the front-rear direction of the frame **20** such that the lower shaft **50** can rotate. In order starting from the right, the lower shaft **50** has a coupling portion **51**, a front-rear feed cam **52**, an up-down feed cam **53**, a shuttle drive gear **54**, and a bearing **55**. The coupling portion **51** is positioned on the right end of the lower shaft **50**. The coupling portion **51** couples the lower shaft **50** to the intermediate shaft (not shown in the drawings), which is supported inside the bed **2** such that the intermediate shaft can rotate. The front-rear feed cam **52** causes a feed bar **67** of the feed mechanism **60** to swing toward the front and toward the rear. The up-down feed cam **53** causes the feed bar **67** to swing upward and downward. The cam faces of the front-rear feed cam **52** and the up-down feed cam **53** are formed into smooth surfaces without any steps. The shuttle drive gear **54** is a helical gear, and rotates an outer shuttle **91** of the shuttle mechanism **90**. The front-rear feed cam **52**, the up-down feed cam **53**, and the shuttle drive gear **54** are formed as a single unit that is made of a synthetic resin material, and are fixed to the lower shaft **50**. The bearing **55** is located on the left end of the lower shaft **50** and supports the lower shaft **50** such that the lower shaft **50** can rotate. The bearing **55** is fixed to a bearing support portion **22** of the frame **20** by the screwing of two screws **57** of a lower shaft anchor plate **56** (only the screw **57** on the front side being shown in FIG. **3**) into threaded holes **23** of the frame **20**.

The shuttle mechanism **90** will be explained. As shown in FIG. **3**, the shuttle mechanism **90** is provided with the outer shuttle **91**, an inner shuttle **92**, a gear **94**, and a shuttle support portion **95**. The outer shuttle **91** rotates in conjunction with the up-down movement of the needle bar **6** (refer to FIG. **1**). The outer shuttle **91** has a hook point (not shown in the drawings) that grips the upper thread. The inner shuttle **92** is disposed on the inner side of the outer shuttle **91** and fits into the outer shuttle **91** such that the inner shuttle **92** can rotate. The inner shuttle **92** has a containing portion **99** that contains a bobbin (not shown in the drawings) around which a lower thread (not shown in the drawings) is wound. The inner shuttle **92** has a locking portion **93**. The rotation of the inner shuttle **92** is restricted by the coming into contact of the locking portion **93** with a rotation-stopping member **42** of the cover member **40** (refer to FIG. **7**). The gear **94** is a helical gear, and is provided such that the gear **94** extends below the lower edge of the outer shuttle **91**. The outer shuttle **91** and the gear **94** rotate as a single unit. The outer shuttle **91** and the gear **94** are supported, such that the outer shuttle **91** and the gear **94** can rotate, by an outer shuttle shaft (not shown in the drawings) that is fixed to the shuttle support portion **95**. The gear **94** engages with the shuttle drive gear **54**, and when the shuttle drive gear **54** rotates, the gear **94** and the outer shuttle **91** rotate. The shuttle support portion **95** is fixed to the frame **20** by two screws **96**.

The feed mechanism **60** will be explained. As shown in FIG. **4**, the feed mechanism **60** is mainly provided with a feed arm **61**, the feed bar **67**, and the feed dog **69**.

The feed arm **61** has an approximately rectangular shape in a front view, and is formed from a metal plate. The left and right ends of the feed arm **61** are provided with flange portions **62** that are formed by being bent toward the rear. A hole **64**, through which a support shaft **63** (refer to FIG. **3**) is inserted, is formed in a lower edge portion of each of the flange portions **62**. As will be described in detail later, the left and right ends of the support shaft **63** are fixed to the frame **20** by keep plates **58** and screws **59** (refer to FIG. **3**). The feed arm **61** is supported such that the feed arm **61** can swing toward the front and toward the rear, with the support shaft **63**, which has been inserted in the holes **64**, serving as the center of rotation. A round hole **65** for coupling the feed arm **61** to the feed bar **67** is formed in an upper edge portion of each of the flange portions **62**. A coupling shaft **66** extends toward the right from a position that is slightly higher than the center of the flange portion **62** on the right side. The coupling shaft **66** couples with a swivel link **78** (refer to FIG. **3**) that will be described later.

The feed bar **67** includes a body portion **68** and a pair of beam portions **70**. The body portion **68** is a plate-shaped portion that is disposed substantially horizontally. The feed dog **69** is fixed to the top face of the body portion **68**. As will be described in detail later, an urging portion **116** for urging the feed bar **67** downward is provided in the center of the rear edge of the body portion **68** (to the rear of the feed dog **69**). The pair of the beam portions **70** are each plate-shaped and extend parallel to one another toward the front from the left and right edges of the body portion **68**. The distance between the pair of the beam portions **70** is slightly narrower than the distance between the pair of the flange portions **62**. A round

hole **71** for coupling the feed bar **67** to the feed arm **61** is provided in the tip of the front end of the each of the beam portions **70**. The feed bar **67** and the feed arm **61** are coupled by coupling members **73** such that the feed bar **67** and the feed arm **61** can swing in relation to one another. Notches **72** for locking the coupling members **73** are formed to the rear of the holes **71** in the beam portions **70**.

The coupling members **73** will be explained. The coupling members **73** are formed from a synthetic resin material that has flexibility. As shown in FIGS. **4** and **5**, each of the coupling members **73** is provided with a base portion **74**, a shaft portion **75**, and a pair of locking portions **76**. The base portion **74** is a rectangular plate-shaped member. The shaft portion **75** is a circular cylindrical shaft that extends orthogonally to the base portion **74** from the center of the plate face of the base portion **74**. The diameter of the shaft portion **75** is slightly smaller than the diameters of the holes **65** in the feed arm **61** and the diameters of the holes **71** in the feed bar **67**. The pair of the locking portions **76** extend parallel to one another from the left and right ends of the base portion **74** in the same direction in which the shaft portion **75** extends. The inner side of the tip of each of the locking portions **76** is slanted such that the inner side of the tip extends toward the inside as it gets closer to the base portion **74**. A step portion **77** (refer to FIG. **5**) is formed on the inner side of each of the locking portions **76** between the tip and the base portion **74**.

In a case where the feed arm **61** and the feed bar **67** are coupled, as shown in FIG. **4**, the positions of the holes **65** in the feed arm **61** are aligned by an operator to the positions of the holes **71** in the feed bar **67**. Next, the shaft portions **75** of the coupling members **73** are inserted into the holes **65** and the holes **71** from the outer side. When the operator pushes on the coupling members **73**, the shaft portions **75** are inserted into the holes **65** and the holes **71** as the pairs of the locking portions **76**, which have flexibility, are deflected toward the outer side. When the step portions **77** (refer to FIG. **5**) on each of the coupling members **73** reach the edges on the inner side of the corresponding beam portion **70**, the deflecting of the pair of the locking portions **76** toward the outer side ceases, and the locking portions **76** are locked to the beam portion **70** by the pulling of the step portion **77** on one of the pair of the locking portions **76** into the notch **72** of the beam portion **70**. The beam portions **70** and the flange portions **62** are thus sandwiched between the base portions **74** and the step portions **77** of the locking portions **76**, such that the feed arm **61** and the feed bar **67** are coupled. The feed bar **67** can swing around the shaft portions **75**. One of the locking portions **76** in each of the pairs of the locking portions **76** is locked to the notch **72** that is provided in the beam portion **70**. Accordingly, the coupling members **73** rotate in conjunction with the swinging of the feed arm **61**, and the locking of the locking portions **76** to the beam portions **70** is maintained. In a case where the coupling of the feed arm **61** and the feed bar **67** is released, the locking of the locking portions **76** to the beam portions **70** is also released, and the coupling can be released simply by pulling out the coupling members **73**.

The structure that causes the feed dog **69** to move toward the front and toward the rear will be explained. As shown in FIG. **3**, the coupling shaft **66** of the feed arm **61** supports the swivel link **78**, which extends toward the rear, such that the swivel link **78** can rotate. A base end portion of a leaf spring **79** is fixed to a base end portion of the swivel link **78**. In a side view, the swivel link **78**, to which the leaf spring **79** is fixed, is shaped like the letter U turned on its side. The front-rear feed cam **52** is positioned between the swivel link **78** and the leaf spring **79**. The leaf spring **79** is urged in the direction that presses the leaf spring **79** against the cam face of the front-rear feed cam **52**. Therefore, the front-rear feed cam **52** is constantly in contact with the swivel link **78**. A projecting portion **80** projects to the right from the free end of the swivel link **78**.

The sewing machine module **8** is provided with a front-rear feed amount adjustment mechanism **81** that adjusts a feed amount in the front-rear direction. A feed adjuster **82** is provided on the left side of the front-rear feed amount adjustment mechanism **81**. An engaging groove (not shown in the drawings) with which the projecting portion **80** of the swivel link **78** engages such that the swivel link **78** can slide is formed on a left side face of the feed adjuster **82**. The feed adjuster **82** is supported in a way that allows its orientation to be changed such that the angle of the engaging groove changes. The angle of the engaging groove, that is, the orientation of the feed adjuster **82**, is controlled by a feed amount setting mechanism (not shown in the drawings) that is provided in the interior of the sewing machine **1**.

When the lower shaft **50** rotates, the swivel link **78** is swiveled up and down by the front-rear feed earn **52**. The engaging groove of the feed adjuster **82** is inclined in relation to the vertical. The reciprocal up-and-down movement of the projecting portion **80** within the engaging groove of the feed adjuster **82** causes the coupling shaft **66**, which supports the swivel link **78**, to swing toward the front and toward the rear around the support shaft **63**, which supports the feed arm **61**. The feed bar **67** and the feed dog **69** thus swing toward the front and toward the rear. When the orientation of the feed adjuster **82** is changed, the angle of the engaging groove changes, so the amount that the coupling shaft **66** moves toward the front and toward the rear (that is, the feed amount for feeding toward the front and toward the rear) changes.

The mechanism that moves the feed dog **69** up and down will be explained. As shown in FIGS. **3** and **6**, an up-down feed lever **83** is provided below the feed bar **67**. The up-down feed lever **83** is provided with a pivot shaft **84**, a cam contacting portion **85**, and a screw contacting portion **86**. The pivot shaft **84** extends in the left-right direction and supports the entire up-down feed lever **83** such that that up-down feed lever **83** can pivots. The left and right ends of the pivot shaft **84** are fixed to the frame **20** by screws (not shown in the drawings). The cam contacting portion **85** extends obliquely downward toward the front from a point that is slightly to the right of the center of the pivot shaft **84** in the left-right direction. A flat face on the front side of the cam contacting portion **85** comes into contact with the up-down feed cam **53**. The screw contacting portion **86** projects upward from the rear side of the pivot shaft **84** in the center of the pivot shaft **84** in the left-right direction. The screw contacting portion **86** comes into contact with the lower end of an adjusting screw **100** (refer to FIG. **6**) that will be described later.

As shown in FIG. **6**, when the lower shaft **50**, which is positioned below the feed bar **67**, rotates, the up-down feed cam **53** causes the up-down feed lever **83** to pivot around the pivot shaft **84**. When the up-down feed lever **83** pivots clockwise, as seen from the left side, the screw contacting portion **86** pushes the adjusting screw **100** upward. This causes the feed bar **67**, which is connected to the adjusting screw **100**, to swing upward. When the up-down feed lever **83** pivots counterclockwise, as seen from the left side, the position of the screw contacting portion **86** drops, so the feed bar **67** swings downward. The feed bar **67** is urged downward by the urging portion **116**, which will be described later, so the up-down feed cam **53** and the cam contacting portion **85** of the up-down feed lever **83** are maintained in a state of contact. Accordingly, the feed bar **67** swings smoothly up and down.

The adjusting screw **100** and the urging portion **116** will be explained. As shown in FIG. **6**, a threaded hole **88** that passes through the feed bar **67** in the up-down direction is formed in the rear edge portion of the feed bar **67**. A threaded portion **101** of the adjusting screw **100** is screwed into the threaded hole **88** from below. The adjusting screw **100** is provided with the threaded portion **101** and a flange portion **102**. A male thread that screws into the threaded hole **88** is formed on the threaded portion **101**. The flange portion **102** has a round plate shape that is larger than the outside diameter of the threaded portion **101**. The flange portion **102** is formed as a single unit with the threaded portion **101**. Knurling (specifically, straight knurling) is formed on the outer circumferential face of the flange portion **102**, although this is not shown in the drawings. In this case, "knurling" refers to a plurality of small ridges and grooves that are formed on the outer circumferential face of a circular cylindrical member. A hexagonal hole **103** is formed at the upper end of the threaded portion **101**. It is possible to move the adjusting screw **100** in the axial direction (the up-down direction) of the threaded hole **88** by inserting a hexagonal wrench (not shown in the drawings) into the hexagonal hole **103** and turning the adjusting screw **100** against the urging force of a leaf spring **105** that will be described later. The distance between the up-down feed lever **83** and the feed bar **67** is adjusted by moving the adjusting screw **100**. The positions of the feed bar **67** and the feed dog **69** in the up-down direction are thus adjusted.

The upper portion (the base end portion) of the leaf spring **105** is fixed to a portion of the feed bar **67** on the rear side of the adjusting screw **100**. The lower portion (the free end portion) of the leaf spring **105** is urged toward the flange portion **102** of the adjusting screw **100**. A projecting portion **106** is formed on the front side of the lower portion of the leaf spring **105**. The projecting portion **106** restricts the rotating of the adjusting screw **100** by being in contact with the knurling (the ridges and grooves of the knurling) that is formed on the flange portion **102** of the adjusting screw **100**. It is therefore possible to prevent the position of the feed bar **67** in the up-down direction from being changed by the unintentional rotating of the adjusting screw **100** by the operator. Because the outside diameter of the flange portion **102** is greater than the outside diameter of the threaded portion **101**, the rotation of the adjusting screw **100** can be adequately restricted even if the urging force of the leaf spring **105** is made smaller.

A circular cylindrical spring cover **110** is fitted over the threaded portion **101** of the adjusting screw **100**. A contact portion **112** on the upper end of the spring cover **110** has a curved shape that protrudes upward. Specifically, the contact portion **112** has a smoothly curved shape that, in a section view, protrudes upward in a direction that is orthogonal to the axial direction of the lower shaft **50** (the left-right direction). A ring-shaped slot **111** into which a compression spring (a coil spring) **114** is inserted from below is formed inside the spring cover **110**. The inserting of the compression spring **114** into the slot **111** causes the spring cover **110** to cover the compression spring **114** from above (from the cover member **40** side). The lower end of the compression spring **114** is in contact with the top face of the feed bar **67**. Therefore, the spring cover **110** is urged upward by the compression spring **114** toward the cover member **40**. Because the spring cover **110** is fitted over the threaded portion **101**, the up-and-down movement of the spring cover **110** is guided smoothly by the threaded portion **101**.

The cover member **40** is mounted such that the cover member **40** covers the spring cover **110**, the feed bar **67**, and the like from above. Therefore, the bottom face of the cover member **40** is in contact with the contact portion **112** on the upper end of the spring cover **110**. The urging portion **116** in which the spring cover **110** and the compression spring **114** are provided therefore urges the feed bar **67** downward, and the state of contact between the up-down feed cam **53** and the cam contacting portion **85** of the up-down feed lever **83** is maintained. Accordingly, the feed bar **67** swings up and down smoothly. In the feed mechanisms of the known sewing machines, the feed bar is generally urged downward by a tension spring. The tension spring must be installed between the feed bar and one of the frame and the machine casing that forms the bed, a task that is cumbersome. In the present embodiment, the operator simply mounts the cover member **40** from above, which completely eliminates the task of mounting the tension spring and dramatically improves the work efficiency.

The feed bar **67** is swung upward and downward, as well as toward the front and toward the rear, by the feed mechanism **60** (refer to FIG. **3**). Therefore, in a case where the upper end of the compression spring **114** is in direct contact with the bottom face of the cover member **40**, and the feed bar **67**, with which the lower end of the compression spring **114** is in contact, swings, the compression spring **114** may fall, be damaged, or the like. However, in the present embodiment, the protruding, curved contact portion **112** of the spring cover **110** that covers the compression spring **114** makes contact with the bottom face of the cover member **40** at a single point. Therefore, even if the feed bar **67** swings in relation to the cover member **40**, all that happens is that the position of the point where the contact portion **112** and the cover member **40** are in contact shifts, so the spring cover **110** does not tilt significantly in relation to the cover member **40**. Falling and the like of the compression spring **114** is thus prevented. Furthermore, no damage is done to the bottom face of the cover member **40** by the compression spring **114**.

The contact portion **112** on the upper end of the spring cover **110** has an upwardly protruding curved shape. Therefore, even if the feed bar **67** swings toward the front and toward the rear, as well as upward and downward, the spring cover **110** can slide smoothly against the cover member **40**.

The frame **20** will be explained. The frame **20** is formed from a synthetic resin material. As described previously, the frame **20** forms what is approximately a box shape, with its top side open. As shown in FIG. **3**, a U-shaped lower shaft insertion portion **21** that is open at the top is formed in the center of the right side face of the frame **20**. The bearing support portion **22**, which is recessed in the shape of a semicircular surface, is provided close to the left edge portion of the frame **20**. The threaded holes **23** are formed in front of and to the rear of the bearing support portion **22**. The lower shaft **50** is placed into the frame **20** from above. At that time, the lower shaft **50** is passed through the lower shaft insertion portion **21**, and the bearing **55** is placed into the bearing support portion **22**. Next, the screws **57** are screwed into the threaded holes **23** from above, fixing the lower shaft anchor plate **56** in place, such that the lower shaft **50** is easily mounted in the frame **20** from above.

A shuttle mounting portion **24** is formed close to the center of the bottom face of the frame **20**. The shuttle mechanism **90** can be mounted in the frame **20** by screwing the screws **96** into threaded holes (not shown in the drawings) in the shuttle mounting portion **24** from above. U-shaped support shaft insertion portions **25** that are open at the top are formed close to the front edge of the frame **20** in two locations on the left and the right. The support shaft **63** of the feed mechanism **60** is placed into the support shaft insertion portions **25** from above. Next, the keep plates **58** (only the keep plate **58** on the right side being shown in FIG. **3**) are fixed in place by the

screwing of the screws **59** (only the screw **59** on the right side being shown in FIG. **3**) into two threaded holes **26**, each of which is provided close to one of the support shaft insertion portions **25**. The support shaft **63** is thus fixed to the frame **20** from above.

Threaded holes **27** for fixing the front-rear feed amount adjustment mechanism **81** in place are formed in two locations close to the right edge of the frame **20**. The front-rear feed amount adjustment mechanism **81** can easily be fixed in place in the frame **20** from above by screwing screws **89** into the two threaded holes **27** from above. U-shaped pivot shaft insertion portions **28** that are open at the top are formed close to the rear edge of the frame **20** in two locations on the left and the right. The pivot shaft **84** of the up-down feed lever **83** can easily be placed into the pivot shaft insertion portions **28** from above and fixed in place with screws (not shown in the drawings). Threaded holes **29** for fixing the cover member **40** are formed in four corners of the upper portion of the frame **20**. The cover member **40** is joined to the frame **20** by the screwing of the screws **49** into the four threaded holes **29**.

The cover member **40** will be explained. As shown in FIG. **3**, the cover member **40** is a metal plate that is approximately rectangular in a plan view. The rigidity of the sewing machine module **8** is ensured by the joining of the plate-shaped cover member **40** to the frame **20**. Steps are formed between the central portion and the left edge portion and the right edge portion of the cover member **40**. The areas where holes **46**, through which the screws **49** are passed, are formed (refer to FIG. **7**) are slightly lower than the central portion. As shown in FIG. **7**, an opening **41** for opening the area above the feed dog **69**, the shuttle mechanism **90**, and the like is formed in the central portion of the cover member **40**. The rotation-stopping member **42** is provided on the right front side of the opening **41**. The rotation-stopping member **42** is provided with a leaf spring **43** on its left edge. The locking portion **93** that is provided in the inner shuttle **92** of the shuttle mechanism **90** (refer to FIG. **3**) comes into contact with the leaf spring **43** of the rotation-stopping member **42**. The rotation of the inner shuttle **92** is accordingly locked by the rotation-stopping member **42**, even if the outer shuttle **91** rotates. A hold-down member **44** is provided slightly to the rear of the rotation-stopping member **42**. The hold-down member **44** projects toward the inside from the edge of the opening **41** and restricts the upward movement of the inner shuttle **92**. In a state in which the inner shuttle **92** is properly mounted in the outer shuttle **91**, a gap exists between the inner shuttle **92** and the hold-down member **44** through which the upper thread is able to pass. However, in a case where a problem occurs for some reason during sewing and the lower thread is pulled out to an abnormal degree, the inner shuttle **92** will sometimes move upward. At a time like this, the inner shuttle **92** comes into contact with the hold-down member **44**, so any further upward shifting (upward movement) of the inner shuttle **92** is restricted. Thus, because the rotation-stopping member **42** and the hold-down member **44** are provided as integral parts of the cover member **40**, the preventing of the rotation of the inner shuttle **92** and the restricting of the upward movement of the inner shuttle **92** are both accomplished just by the joining of the cover member **40** to the frame **20**.

As explained above, in the sewing machine module **8**, the frame **20** is formed such that the frame **20** encloses the side faces and the bottom faces of the feed mechanism **60** and the shuttle mechanism **90**. The top side of the frame **20** is open. The operator is therefore able to attach the members that form the feed mechanism **60**, the shuttle mechanism **90**, and the like to the frame **20** from above the frame **20**. In a state in which the feed mechanism **60** and the shuttle mechanism **90** have been attached to the frame **20**, the rigidity of the entire sewing machine module **8** is ensured by using the screws **49** to join the cover member **40** and the frame **20**. The operator is therefore easily able to manufacture the sewing machine module **8** such that the sewing machine module **8** is provided with high rigidity. More specifically, there is no need to create a base for the mounting of the feed mechanism **60**, the shuttle mechanism **90**, and the like by bending a metal plate. It is also not necessary for the operator to attach members to a base from a plurality of directions. The sewing machine module **8** can thus be manufactured with high rigidity easily and at a low cost.

The urging portion **116** urges the feed bar **67** downward by coming into contact with the bottom face of the cover member **40**. Therefore, the state of contact between the up-down feed lever **83** and the up-down feed cam **53** is maintained, and the feed bar **67** is swung upward and downward smoothly, just by the joining of the cover member **40** to the frame **20**. The operator can thus easily manufacture the sewing machine module **8** such that the feed bar **67** swings smoothly.

The operator is able to adjust the position of the feed bar **67** by turning the adjusting screw **100** to adjust the distance between the up-down feed lever **83** and the feed bar **67**. Furthermore, the leaf spring **105**, which is urged toward the adjusting screw **100**, restricts the rotation of the adjusting screw **100**. Therefore, with a simple structure, the sewing machine module **8** is able to prevent the position of the feed bar **67** from being changed by the unintentional rotating of the adjusting screw **100** by the operator.

In the present embodiment, the spring cover **110**, which covers the compression spring **114**, comes into contact with the bottom face of the cover member **40**. Therefore, falling of and damage to the compression spring **114** are prevented, as are similar problems, unlike in a case where the compression spring **114** makes direct contact with the cover member **40**. Moreover, no damage is done to the bottom face of the cover member **40** by the compression spring **114**. The sewing machine module **8** can therefore operate smoothly. In addition, the contact portion **112** of the spring cover **110** has a curved shape that protrudes upward. The spring cover **110** is therefore able to slide more smoothly against the cover member **40**.

In the present embodiment, the feed arm **61** and the feed bar **67** are coupled by the coupling members **73**. The locking portions **76** of the coupling members **73** allow the movements by which the shaft portions **75** are inserted into the holes **65** and the holes **71**, and the locking portions **76** are locked to the beam portions **70** in a state in which the shaft portions **75** extend through the holes **65** and the holes **71**. Therefore, unlike in a case where retaining rings or the like are used, the operator can easily couple the feed arm **61** and the feed bar **67** simply by pushing the shaft portions **75** of the coupling members **73** into the holes **65** and the holes **71**. The operator can also easily release the coupling by undoing the locking of the locking portions **76**.

In the present embodiment, the rotation-stopping member **42** and the hold-down member **44** are provided as integral parts of the cover member **40**. Therefore, the locking of the rotation of the inner shuttle **92** and the restricting of the upward movement of the inner shuttle **92** are easily accomplished simply by joining the cover member **40** to the frame **20**. Because the number of parts is less than in the known sewing machine module, the manufacturing cost and the operating burden are further reduced.

In the present embodiment, the frame **20** is formed from a synthetic resin material, and the cover member **40** is formed from a metal plate. The forming of the frame **20** from the

synthetic resin material makes it possible for the operator to manufacture the frame **20**, which is designed to allow many parts to be mounted from above, easily and at low cost. In contrast, a metal plate with high rigidity is used for the cover member **40**, so the rigidity of the entire sewing machine module **8** can be enhanced by the joining of the frame **20** and the cover member **40**. Moreover, because the cover member **40** has a substantially flat plate shape, processes such as complex bending and the like of the metal plate are not required.

The present disclosure is not limited to the embodiment that is described above, and various types of modifications can be made. For example, in the embodiment that is described above, the frame **20** is formed from a synthetic resin material. The frame **20** can therefore easily be created with a complex shape. However, the frame **20** may also be formed from a material other than a synthetic resin material. Furthermore, in the embodiment that is described above, the cover member **40** is formed from a metal plate with high rigidity, so the rigidity of the entire sewing machine module **8** is ensured. However, the material of the cover member **40** may also be changed. In the embodiment that is described above, it is also desirable for the rotation-stopping member **42** and the hold-down member **44** to be provided as integral parts of the cover member **40**. However, at least one of the rotation-stopping member **42** and the hold-down member **44** may also be provided as a separate member.

In the embodiment that is described above, some of the areas to the sides and below the feed mechanism **60** and the shuttle mechanism **90** are covered by the frame **20**, while other areas are left open. However, the entire area to the sides and below the feed mechanism **60** and the shuttle mechanism **90** may also be covered by the frame **20**. In that case, the rigidity is improved even more. Furthermore, in the embodiment that is described above, the cover member **40** is joined to the frame **20** by the screws **49**. Therefore, the frame **20** and the cover member **40** can be joined easily and strongly, and the joining can be easily undone. However, the frame **20** and the cover member **40** may also be joined by snap fits, welding or the like.

In the embodiment that is described above, the up-down feed lever **83** comes into contact with the up-down feed cam **53**. However, one of a portion of the feed bar **67** and a member that is fixed to the feed bar **67** (for example, the adjusting screw **100**) may also come into direct contact with the up-down feed cam **53**. Even in that case, the feed bar **67** will swing up and down smoothly.

In the embodiment that is described above, the urging portion **116** is configured using the spring cover **110** and the compression spring **114**. However, as long as the spring cover **110** covers at least the end of the compression spring **114** on the side toward the cover member **40**, it is not necessary for the spring cover **110** to cover the entire compression spring **114**. A leaf spring may also be used instead of the compression spring **114**. In a case where a leaf spring is used, it is also acceptable for the spring cover **110** not to be used.

In the embodiment that is described above, the spring cover **110** is fitted over the threaded portion **101** of the adjusting screw **100**, so the up-and-down movement of the spring cover **110** is guided smoothly by the threaded portion **101**. However, the urging portion **116** may also be provided in a position other than the position of the adjusting screw **100**. In the embodiment that is described above, the lower end of the compression spring **114** is in contact with the top face of the feed bar **67**, so the feed bar **67** is urged downward. However, it is also acceptable for the compression spring **114** not to be in contact with the feed bar **67**. For example, the compression spring **114** may also downwardly urge the feed bar **67**, to which the adjusting screw **100** is attached, by coming into contact with the adjusting screw **100** and urging the adjusting screw **100** downward. In other words, the wording "the compression spring that is provided on the feed bar" is not wording that is intended to be limited to a case in which the compression spring is in contact with the feed bar.

In the embodiment that is described above, the rotation of the adjusting screw **100** is restricted by the contact of the projecting portion **106** of the leaf spring **105** with the knurling on the flange portion **102** of the adjusting screw **100**. However, the structure for restricting the rotation of the adjusting screw **100** may also be modified. For example, the flange portion **102** of the adjusting screw **100** may be omitted, and the leaf spring **105** may be made to come into direct contact with the threaded portion **101** of the adjusting screw **100**. In a case where the flange portion **102** is provided, it may also be provided above the feed bar **67** instead of below the feed bar **67**. The projecting portion **106** of the leaf spring **105** may also be omitted. The rotation of the adjusting screw **100** may also be restricted by using a member other than the leaf spring **105** to apply a force to the adjusting screw **100**.

The structures of the coupling members **73**, the method of using the coupling members **73** for coupling the feed arm **61** and the feed bar **67**, and the like can be modified as desired. For example, in the embodiment that is described above, the coupling members **73** are inserted into the holes **65** and the holes **71** from the outer sides on the left and the right. However, the coupling members **73** may also be mounted from the inner sides. In the embodiment that is described above, two of the locking portions **76** are provided on each of the coupling members **73**, but the number of the locking portions **76** can also be changed.

What is claimed is:

**1**. A sewing machine module that is mounted in a sewing machine, comprising:

a feed mechanism;

a shuttle mechanism;

a frame that covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism and that supports the feed mechanism and the shuttle mechanism in a state in which a top side of the feed mechanism and a top side of the shuttle mechanism are open;

a cover member that is formed into a flat plate shape and that covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame; and

a joining mechanism that joins the frame and the cover member, wherein

the feed mechanism includes

a feed dog,

a feed bar that supports the feed dog and is configured such that the feed dog swings up and down,

a lower shaft that is supported by the frame below the feed bar and is configured such that the lower shaft rotates,

an up-down feed cam that is fixed to the lower shaft,

an urging mechanism that is provided on the feed bar, that is in contact with a bottom side of the cover member, and that urges the feed bar downward, and

a contacting element that maintains a state of contact with the up-down feed cam, such that the feed bar is urged downward by the urging mechanism, and that, by swinging in conjunction with rotation of the up-down feed cam, causes the feed bar to swing up and down.

2. The sewing machine module according to claim 1, further comprising:

an adjusting screw that is provided in the feed bar and that adjusts a distance between the contacting element and the feed bar; and

a leaf spring that is urged such that the leaf spring is in contact with and presses against the adjusting screw and that restricts rotation of the adjusting screw.

3. The sewing machine module according to claim 1, wherein

the urging mechanism includes

a compression spring that is provided on the feed bar, and

a spring cover that covers at least an end portion of the compression spring on the side toward the cover member and that is urged by the compression spring such that the spring cover is in contact with and presses against the cover member.

4. The sewing machine module according to claim 3, wherein

the spring cover includes a contact portion that has a curved shape that protrudes upward and that is in contact with the bottom side of the cover member.

5. The sewing machine module according to claim 1, wherein

the feed mechanism further includes

a feed arm that supports the feed bar and is configured such that the feed bar swings, and

a coupling member that couples the feed arm and the feed bar and is configured such that the feed arm and the feed bar swing, and

the coupling member includes

a shaft portion that extends through a first hole that is formed in the feed bar and a second hole that is formed in the feed arm, and

a locking portion that has flexibility, that allows the shaft portion to move such that the shaft portion is inserted into the first hole and the second hole, and that is locked to at least one of the feed bar and the feed arm in a state in which the shaft portion extends through the first hole and the second hole.

6. A sewing machine module that is mounted in a sewing machine, comprising:

a feed mechanism

a shuttle mechanism;

a frame that covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism and that supports the feed mechanism and the shuttle mechanism in a state in which a to side of the feed mechanism and a to side of the shuttle mechanism are open;

a cover member that is formed into a flat plate shape and that covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame; and

a joining mechanism that joins the frame and the cover member, wherein

the shuttle mechanism includes

an outer shuttle that grips a thread, and

an inner shuttle that is fitted into an inner side of the outer shuttle in a state in which the inner shuttle is rotatable in relation to the outer shuttle, and wherein

the cover member includes

a rotation-stopping member and a hold-down member as integral parts of the cover member, the rotation-stopping member coming into contact with a portion of the inner shuttle and locking the rotation of the inner shuttle, and the hold-down member restricting upward movement of the inner shuttle.

7. A sewing machine module that is mounted in a sewing machine, comprising:

a feed mechanism;

a shuttle mechanism

a frame that is formed from a synthetic resin material and that covers at least a portion of a side face of the feed mechanism, a portion of a side face of the shuttle mechanism, a portion of a bottom face of the feed mechanism, and a portion of a bottom face of the shuttle mechanism and that supports the feed mechanism and the shuttle mechanism in a state in which a top side of the feed mechanism and a top side of the shuttle mechanism are open;

a cover member that is formed from a metal plate into a flat plate shape and that covers the top side of the feed mechanism and the top side of the shuttle mechanism that are supported by the frame; and

a joining mechanism that joins the frame and the cover member.

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